An Introcluction to Trenchle

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The Importance of Underground utilities

- Questionnaire by the Lancet in 2000's on Utilities
- Difference between first and third world.
- \$15 b in Lower Mainland (BC WM Act)
- Culverts in Lower Mainland 25,000
- Why trenchless and not open cut?

Added benefit of Trenchless vs. Open Cut Carbon Emissions Savings



Presentation today on Trenchless technology

A brief list of some of the methods and where these methods are used.

1 Rehabilitation

2 New Construction

Questions to ask when looking at Pipe Rehabilitation

Firstly, what is a pipe?

- 1 A vessel to contain a liquid.
- 2 A conduit to transport a liquid.
- 3 A structure to maintain a tunnel.
- Today we are going to address rehabilitation when we have failures in one or more of the above attributes of a pipe.

First half of Topics Covered Today Rehabilitation

Rehabilitation

- CIPP
- Culvert rehab
- Sprayed on Cementitious liners.
- Fold and Form
- 💽 Primus liner

Sliplining

CIPP

Rehabilitation method of Trenchless to get back the ability to contain and carry liquid.

Will not increase diameter but will have "Manning's value" of .009

CIPP positioned by Air or water pressure and cured using hot water/ steam or UV light.

It is deemed a close fit product.

Can be used on sewers / pressure pies

Wetting out the CIPP/ Manufacturing of Pipe



CIPP





Typical finished CIPP liner blue inside a white PVC pipe.



Culvert failures and some types of Rehab



Exit Controlled Culvert Failures Structure unknown



Entrance Controlled Culvert with Invert Failure 1/4



Finished Concrete Work



Centrifuge Applied Materials



Sliplining and Internal Rehab

- Can be used in sewer and pressure pipes.
- Loses some diameter but generally lower
 - Manning's N value.
- Not great in sewers with connections.
- Annulus needs grouting depending on
 - design.
- The pipe may be folded down like fold and
 - form or installed in final section.
- New Pipe is made by others.

Fold and Form Pipe Rehabilitation for Gravity/Pressure

- Plastic pipe is folded, pulled into an existing pipe then expanded to form a tight fit structural liner.
- A new pipe inside the old pipe.
- The pipe deformed elastically and not plastically.



Sliplining Repair & Rehabilitation



Primus liner/flexible pressure liner



Iength to 1000m+
Pressure/16 bar type #
Can be lined around bends
Flange ends

Sliplining an old brick sewer under Ross bay cemetery in Victoria

Structure failing slowly/structure unknown



Sliplining of Large dia. Sewers

3.3m wide X 2m high CSP lined with GRP



Culvert rehab in North Vancouver of failing Wood stave pipe





Live sliplining of sewers. North Surrey interceptor 2021



LIVE SLIPLINING SUMMER OF 2021



Sliplining CSP with CSP in Delta



Second half Methods of New Construction

- I New Construction HDD/pipe ramming/pipejacking
- tunneling/micro tunneling
- pipe bursting.
- SUE (Subsurface Utility Engineering)
- 2 Carbon. The carbon calculator for trenchless construction.

Horizontal Directional Drilling a new Construction method

Can be accurate enough for sewers of 0.5% grade.

More suited to homogenous ground especially for gravity pipes.

Diameters from 25mm to 2000mm.

Lengths from 20m to 4000m plus.

Horizontal Directional Drilling New construction / Replacement 1/2

Installation of pipes in a shallow arc using a surface launched drilling rig.



Design of a Bore Path for HDD



HDD Demonstration



Pipe Ramming / Jacking

New Construction Method.

Diameters from 300 to 3500.

Lengths say 60 to 80 m max.

Pipe Ramming



More Ramming



Pipe jacking/ Microtunneling



Burnell's tunnelling machine 1860's



Pipe Ramming

Issues +/-

- 1. Very loud.
- 2. Pneumatic hammer
- Can install from 300mm to 3000.
- 4. Grade issues in mixed ground.

Pipe Jacking

Issues =/-

- 1. Bigger diameters.
- 2. Mainly man entry.
- 3. Reaction wall needed.
- 4. Better grade control.

Tunnel Boring/ microtunneling Machine



Tunnel Boring Machine



Pipe Bursting

 Rehabilitation/new construction Method.
Diameter 25mm to 1200mm.
Length 150 +/-m.
Pneumatic or Static.

Typical Pipe Bursting parameters.

- I Normal range is 2 to 3 up sizes?
- 2 Used when existing pipe is too small
- 3 Used when pipe is partially collapsed, or joints offset.



Typical bursting situation



Record Maple Ridge Burst 375 to 950 upsize a 5pipe size or 6.5 times increase



Township of Langley Upsize 450 Conc to 800HDPE



Lateral Pipe Bursting The other extremes of pipe bursting



A typical Pipe Burst in an alley New West 1.5m pits every 20 m 92% reduction



Toolkit.bc.ca

GREEN COMMUNITIES CARBON NEUTRAL FRAMEWORK OPTION 1: PROJECT PROFILE TRENCHLESS TECHNOLOGY CAPITAL PROJECTS

Project Profile Overview

This project profile provides guidance on estimating the amount of greenhouse gas (GHG) emissions that can be reduced by using a "trenchless technology" for capital projects to upgrade, repair, replace or construct a water or wastewater utility pipe, instead of using conventional open-cut trenching.

In contrast to traditional trenching, which involves digging a trench, hauling extracted material to a disposal site and replacing with new material, trenchless technologies involve drawing a new pipe (or pipe lining) along the path of an existing pipe or boring for new constructions. In turn, it requires removal of less material than conventional trenching, with consequent reductions in diesel fuel consumption and related GHG emissions. GHG emissions have the potential to be significantly reduced by using trenchless technologies instead of conventional trenching. These reductions are dependent on the location of the project and the sites to/from which material is hauled, the type of soil that the utility pipe is in, the number of lateral connections to the pipe and the type of trenchless technology used.

General Trenchless Information NASTT.org

Carbon:- www.toolkit.bc.ca/carbon-neutral-goverment. Pipe Bursting :-TT Technologies/P W **Trenchless** CIPP:-Insituform /Aegion **Tunneling machines:- Ackerman/Herrenknect** Primus Line/Channeline. Slipline:-HDD:-Vermeer